

FIGURE 1

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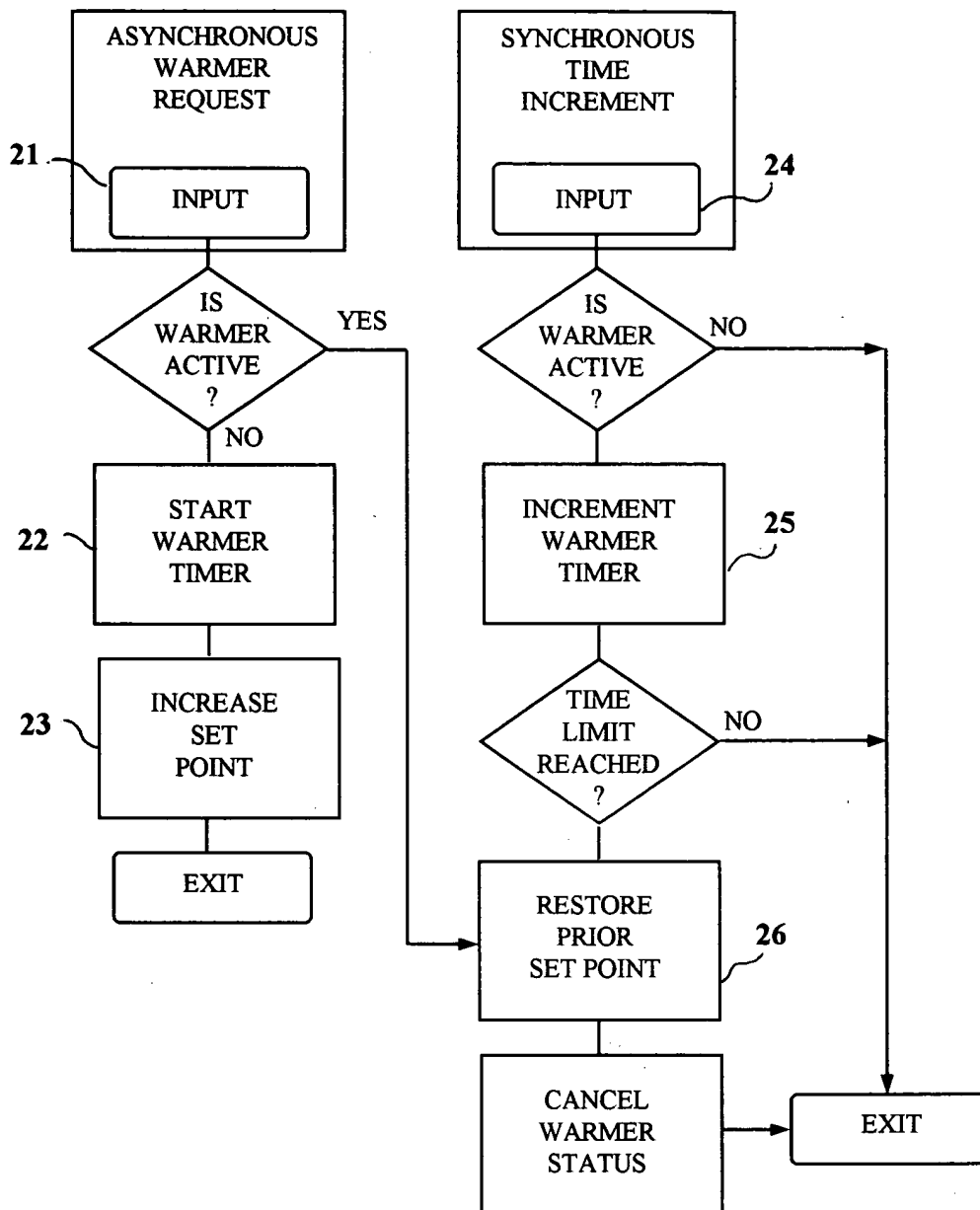
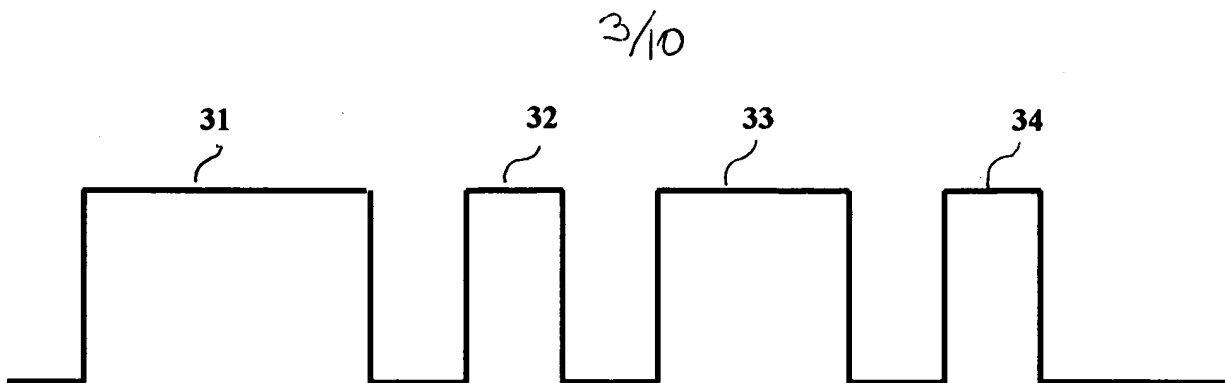


FIGURE 2



**FIGURE 3**

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# Warmer

```
movlw 0x20
xorwf Tcontrol,f ;flip warmer status
btfss Tcontrol,WarmON
goto FinishWarm
```

# WarmUp

```
incf CT1,f

movlw d'90' ; set timer for 90 minutes
movwf WarmTime
; change display line 2 and show
```

# WarmChange

```
call readTC77
call Warm_Message
call display_lcd
bsf BkLt
movlw d'60'
goto Vtime
```

# FinishWarm

```
decf CT1,f
clrf WarmTime
goto WarmChange
```

# CheckWarm

```
btfss Tcontrol,WarmON ;check if warm on
return ;exit if not
decfsz WarmTime,f ;reduce time to go by one minute
return
goto Warmer ;if zero time, reset
```

# KillWarm

```
btfsc Tcontrol,WarmON ;check if warm on
decf CT1,f ;if Warm was on, decrease current set
bcf Tcontrol,WarmON ;ensure Warm status is off
clrf WarmTime ;ensure Warm timer is zero
return
```

**FIGURE 4**

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# TRANSMIT

```

;-----Send 1.5ms Synch Pulse-----
    bsf    TrOut ;set output line high
    movlw d'250'
    movwf Timex
    call   Tdelay ;six times value in Timex
    call   SendLow ;set output low for 1/2 ms
;-----Send Data-----
ExamHeat
    btfsc  Tcontrol,HeatON ;check for call for heat
    goto   SendHeat
    call   SendZero
    goto   ExamAC
SendHeat
    call   SendOne
ExamAC
    btfsc  Tcontrol,CoolON ;check for call for A/C
    goto   SendCool ;If calling, send cool signal
    call   SendZero
    goto   ExamFan
SendCool
    call   SendOne
    goto   SendFan ;If cool call, also turn fan on.
ExamFan
    btfsc  Tmode,FanMode ;check for call for fan
    goto   SendFan
    goto   SendZero
SendFan
SendOne    bsf    TrOut ;set output line high
           call   HalfMs ;send synch phase of pulse
;-----send .5 ms high followed by .5 ms low
SendZero   bsf    TrOut ;set output line high
Sendmore   call   HalfMs ;maintain line level for half ms
SendLow    bcf    TrOut ;set output line low
HalfMs     movlw  d'83' ;set wait period for 1/2 ms
           movwf Timex ;
Tdelay     nop ;burn a cycle for correct timing
           goto   Tdly ;2 more microseconds
Tdly       decfsz Timex,f ;count down to correct time
           goto   Tdelay ;
           return

```

FIGURE 5

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-----FINDDATA routine: reads data from upper unit-----

```

MAIN clrf   DataBuf
      btfss  Input      ;test com line for high level
      goto   MAIN       ;must find high level to start

FINDDATA
      movlw  3
      movwf  BitCount   ;set up number of bits to get
      clrf   Futil
      call   HiTime      ;look for start pulse
      addwf  Futil,w     ;check return code
      btfsc  STATUS,2   ;abnormal return code is zero, which sets carry
      goto   MAIN       ;start fresh if time exceeded
      movlw  d'128'     ;see if pulse is at least 1280us
      subwf  Timex,w
      btfss  STATUS,0   ;carry set means pulse > 1.28 ms
      goto   MAIN       ;invalid start pulse if < 1.28 ms
      movlw  d'172'     ;see if pulse is under 1720us
      subwf  Timex,w
      btfsc  STATUS,0   ;carry set means pulse > 1.72 ms
      goto   MAIN       ;invalid start pulse if > 1.72 ms
      ;
      ;               VALID START FOUND - 1.5 ms (+/- 15%)
      GetaBit call   LoTime      ;check pre-data interval
      addwf  Futil,w     ;check return code
      btfsc  STATUS,2   ;abnormal return code is zero, which sets carry
      goto   MAIN       ;start fresh if time exceeded
      movlw  d'40'      ;see if pulse is at least 400us
      subwf  Timex,w
      btfss  STATUS,0   ;carry set means pulse > 0.4 ms
      goto   MAIN       ;invalid start pulse if < 0.4 ms
      movlw  d'60'      ;see if pulse is under 600us
      subwf  Timex,w
      btfsc  STATUS,0   ;carry set means pulse > 0.6 ms
      goto   MAIN       ;invalid start pulse if > 0.4 ms
      ;
      ;               VALID INTERVAL FOUND
      call   HiTime      ;measure data pulse
      addwf  Futil,w     ;check return code
      btfsc  STATUS,2   ;abnormal return code is zero, which sets carry
      goto   MAIN       ;start fresh if time exceeded
      movlw  d'40'      ;see if pulse is at least 400us
      subwf  Timex,w
      btfss  STATUS,0   ;carry set means pulse > 0.4 ms
      goto   MAIN       ;invalid data pulse if < 0.4 ms

```

**FIGURE 6**

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```

movlw d'60'           ;see if data pulse is under 600us
subwf Timex,w
btfss STATUS,0        ;carry set means data > 0.6 ms
goto SetZero          ;data bit is zero if .6ms > data > 0.4 ms
;
movlw d'85'           ;see if pulse is at least 850us
subwf Timex,w
btfss STATUS,0        ;carry set means pulse > 0.85 ms
goto MAIN             ;invalid data pulse if < 0.85 ms
                        ;data is at least 850us
;
movlw d'115'          ;see if data pulse is under 1150us
subwf Timex,w
btfss STATUS,0        ;carry set means data > 1.150ms
goto SetOne           ;data bit is one if 1.15 ms > data > 0.85 ms
goto MAIN             ;data is invalid if over 1.15 ms

```

#### SetZero

```

rlf      DataBuf,f      ;shift bits left one place
bcf      DataBuf,0      ;place the current bit
decfsz BitCount,f      ;update number of bits to go
goto GetaBit            ;and get the next one
goto EndData           ;but Wrap up if done

```

#### SetOne

```

rlf      DataBuf,f      ;shift bits left one place
bsf      DataBuf,0      ;place the current bit
decfsz BitCount,f      ;update number of bits to go
goto GetaBit            ;and get the next one
goto EndData           ;but Wrap up if done

```

EndData ;validate, move data from buffer to control

#### Outputs

```

btfss DataBuf,2        ;call for heat?
goto ValidData         ;if no, data OK
btfsc DataBuf,1        ;if yes, call for A/C?
goto MAIN              ;ignore simultaneous calls for heat and cool

```

#### SET OUTPUT CONTROL

#### ValidData

```

movf DataBuf,W
movwf OUT
return

```

**FIGURE 7**

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|        |        |         |  |
|--------|--------|---------|--|
| HiTime |        |         | ;HiTime times high level in units of 10us<br>;until transistion to low level is found. |
|        | clrf   | Timex   | ;reset timer   |
| Hitest |        |         |  |
|        | btfss  | Input   | ;test com line for high level  |
|        | retlw  | 0x01    | ;transition to low occurred -normal exit   |
|        | nop    |         | ;add 1us   |
|        | btfss  | Input   | ;test com line for high level  |
|        | retlw  | 0x01    | ;transition to low occurred -normal exit   |
|        | btfss  | Input   | ;test com line for high level  |
|        | retlw  | 0x01    | ;transition to low occurred -normal exit   |
|        | incfsz | Timex,f | ;add a 10 us time unit to timer  |
|        | goto   | Hitest  | ;and continue checking input   |
|        | retlw  | 0x00    | ;exit with time exceeded code  |

|        |        |         |  |
|--------|--------|---------|--|
| LoTime |        |         | ;LoTime times low input level in units of  |
| 10us   |        |         | ;until transistion to high level is found. |
|        | clrf   | Timex   | ;reset timer                               |
| Lotest |        |         |  |
|        | btfsc  | Input   | ;test com line for low level               |
|        | retlw  | 0x01    | ;transition to high occurred -normal exit  |
|        | nop    |         | ;add 1us                                   |
|        | btfsc  | Input   | ;test com line for low level               |
|        | retlw  | 0x01    | ;transition to high occurred -normal exit  |
|        | btfsc  | Input   | ;test com line for low level               |
|        | retlw  | 0x01    | ;transition to high occurred -normal exit  |
|        | incfsz | Timex,f | ;add a 10 us time unit to timer            |
|        | goto   | Lotest  | ;and continue checking input               |
|        | retlw  | 0x00    | ;exit with time exceeded code              |

**FIGURE 8**



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:100000000000FF0FFF0FFF0FFF0FFF0FFF0FFF0F8E  
:10001000FF0FFF0FFF0FFF0FFF0FFF0FFF0F4B0A29  
:1000200043006F007000790072006900670068008B  
:1000300074002000320030003000330020006200E5  
:1000400079002000440048005300000020004300D5  
:1000500038002D003000380030003500300033000B  
:1000600020004200410053004500000020006600CF  
:100070006F007200200043004F004D004600590001  
:100080002D0053005400410054002000280054006B  
:100090004D00290000009F0C02006600200C0600A5  
:1000A0008307550A69006800040083065F0A080593  
:1000B0000A0C29007800860546040604260404007C  
:1000C00083090807670AE902730A08048604180608  
:1000D000260518072604580646055807460438061C  
:1000E0000605380706047D095F0A200C34007500F8  
:1000F000F502780AF402770A0108400C3600750907  
:10010000F6027F0AFF087800A607830A030C320074  
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:10012000830AAC0C90000306830AD009D101430670  
:10013000830A280C90000307830A3C0C90000306F6  
:10014000830AC509D1014306830A280C90000307DE  
:10015000830A3C0C90000307B60A550C9000030775  
:10016000830A730C90000307BB0A830A7803180400  
:10017000F202950AC00A78031805F202950AC00A2D  
:100180005807C40A3806830AFF087000A60701084A  
:100190000000A6070108A6070108F003C60A000828  
:1001A0007000A60601080000A6060108A6060108C0  
:0601B000F003D10A000873  
:021FFE00EE0FE4  
:00000001FF

**FIGURE 9**

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:100000000000F28820764340A344320382035204A  
:100010006220342031203120392034200020A001FA  
:10002000850107309F0003138316203085003D3083  
:10003000860081138312031385018601DE01DE0A27  
:1000400005158515D90101301C22A10002301C22A2  
:10005000D00F2B281430FB0003301C22D00F312886  
:100060000301FC000F30D300D80088200530A02009  
:10007000DE0B4628831203134E22712172223C307C  
:10008000A020B62280207227830DE00B6225620A0  
:10009000B020A11D4D28A1115228581953285818D5  
:1000A0005328D81C72226620A5203828A0112012BF  
:1000B0007B082A0203195D2861287C082B0203199A  
:1000C00008000318A015031C20160800211C78281E  
:1000D000A0188628201C7228201A8A2820198A280D  
:1000E00020108728201E8A2820198A282014872873  
:1000F000A11C902820187028A01D822820198A2869  
:10010000A0148728A01C8A2820198A28A010BF3094  
:10011000D4002015201D0800D40B08002011080071  
:100120002010A0108728D30B98281430D300DA238E  
:100130002030DA00DB01DB0B9B28DA0B9A28013434  
:10014000D009320DF08A12808002830D5000B2307  
:100150009320D508A728D80B08003C30D800CC2B17  
:100160004330B0004F30B1004D30B2004630B300E4  
:100170005930B4002030B5005430B6004530B700D7  
:100180004D30B8005030B9002030BA00B00BC0080  
:100190004D30C0002A082E2271080319D128710899  
:1001A0002322720823226F30C1006430C200653000  
:1001B000C3003A30C4004F30C5004630C600463058  
:1001C000C7002030C800C900CA00C800CC00CD0059  
:1001D000CE00CF00D42226082E2270080319F22860  
:1001E0002322BB007008031DF82871080319FB289F  
:1001F00071082322BC00031372082322BD002E3095  
:10020000BE003030A71D05293530BF00211C132941  
:100210004830C5006530C6006130C7007430C80082  
:10022000201837292E29A11C20294330C5006F3002  
:10023000C6006F30C7006C30C800A01837292E298F  
:10024000211D2E294630C5006130C6006E30C70022  
:100250002030C8004F30C9004E30CA00A01E3629D9  
:100260005730CD007230CE006D30CF0008006930BD  
:10027000C9006E30CA006730CB002E292A30B0008A  
:100280005330B1004530B2005430B3002A30B400CE  
:100290002030B5002030B500C000C100C200C3004E  
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:1002D0004F30B1005730B2004530B3005230B40057  
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:10032000BF002030C000C1004130C2003530C300E2  
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:100350006F30CC006C30CD002030CE002030CF008C  
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:100380004E30C8002030C900CA00CB00CC00763007

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:10061000A803AA070800A013061C362B861E692B08  
:10062000061E682B861D172B061DBC2B08000130EB  
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:1006500072221D2B3C30DC009320861D242BDC0BEA  
:100660002C2BA115DC0A201F0800582B01301C225B  
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:1006D000A017A1157B08AA00A01AAA037C08AB00EA  
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:10078000FB0A5A30D900B622B0207222A1153C30A3  
:10079000A028FB03D901C32BA01E0800D90B080019  
:1007A000BC2B0A30A0200800A030D200AB22D0B14  
:1007B000D62B08008614F530D700F423F123201837  
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:1007D000ED23ED2B2119ED2BEF2B8614F22386143C  
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FIGURE 10